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EDITORIAL NOTES

ELECTRICITY DEVELOPMENT PLAN

A FIVE-YEAR plan undertaken by the Central Electricity Board for increasing the generating capacity of the selected stations which feed the grid was announced last Thursday. Described as "the biggest expansion programme on record," it aims at "meeting the demand for electricity after the war." A programme of new generating stations and extensions of existing stations comprising an aggregate of over 3,000,000 kilowatts of new plant and covering the period to the winter of 1948 contemplates an expenditure by the selected station owners of over £90,000,000. In the past nine months, it is stated, the Board completed arrangements to meet the load in the winter of 1946, and provide extensions to deal with anticipated demands in the two following winters. Station owners have been directed to install new turbines, boilers, and cooling towers to increase their generating capacity by 900,000 kilowatts by the winter of 1946, and by a further 340,000 kilowatts by the following winter. Three new selected stations are to be built, the first sections of which are to have an aggregate capacity of 270,000 kilowatts by the winter of 1947. The remainder of the extensions are scheduled for 1947 and 1948. Government authority will be required, but to avoid delay the Board has arranged with the selected station owners concerned, including those who are to provide two new stations, to proceed at once with the preparation of designs and specifications and the placing of provisional contracts.

Ninety million pounds, about as much as it costs us to run the war for a week, is a lot of money, and the financial experts have not given the investing public very much help in forming an opinion of the scheme. It may be that the big extensions already carried out to meet war production needs are counted as part of the scheme. If the industry is satisfying present abnormally heavy requirements, it would appear that when war production ceases at the end of hostilities there will be a substantial margin of plant to meet immediate post-war consumptions. We do not know whether, and if so to what extent, the present output falls short of demand, nor can we assess the "greatly increased demand for electricity after the war." Lacking such knowledge, we can only regard the programme as an expression of optimism on the grand scale.

Between now and the winter of 1948 the Gas Industry, too, will be spending large sums, probably many millions of pounds, on extensions to meet the post-war demand for gas, but unlike the electricity industry it has not yet told the Press or the B.B.C. what its plans are, or whether it has any plans ready. Structurally the Gas Industry may not lend itself to a plan of the same pattern, but we must envisage wholesale expansion following a firm co-ordinated and over-riding policy; and in any event the time is rapidly approaching when the renovations and extensions of plant, extensions of distribution mains, and interlinking of adjacent systems foreshadowed in the Planning Report must take shape if they are ever to be realized—and this only as a first step. The Planning Report has been followed by the reports of the Association of Municipal Corporations and the Association of Smaller Municipal Gas Undertakings, and the Committee of Enquiry into the Gas Industry is collecting evidence as to the changes that are necessary in order to develop and cheapen gas supplies to all types of consumer, but until the evidence is published we have no means of knowing whether it contains a cut and dried plan of extensions on anything like the lines of the £90,000,000 electricity scheme, or even any definite proposals for new regional gas grids on a scale commensurate with the Industry's known potentialities. It was stated in the Planning Report that doubling of gas output would not necessarily mean a doubling of carbonizing plant. But it does call for a properly ordered plan—a plan including the harnessing of coke-oven gas—the groundwork for which has been prepared in the various surveys carried out by the Industry in the past two or three years.

DIM-OUT STREET LIGHTING

RELAXATION in September last of the drastic blackout regulations did not synchronize with immunity from air attack, as far as Southern England was concerned, for which reason, no doubt, the dim-out has been patchy, and in fact in many areas much dimmer than existing regulations permit. In regard to street lighting we have for a variety of reasons witnessed the same patchiness, and what the public—or a large section of it—considered to be a reluctance on the part of lighting authorities and of gas and electricity suppliers to put into speedy effect the Government's permission to arrange for what has come to be known as "moonlight" lighting—*i.e.*, an illumination not exceeding 0.02 foot-candle, compared with the 0.0002 foot-candle of "starlight" lighting.

In the "JOURNAL" of Sept. 13, a few days before the relaxation of the blackout came into operation, we reviewed the position at some length, mentioning that the partial lifting of the blackout did not find the Gas Industry unprepared, that for a considerable time there had been close collaboration between the Industry, the Government Departments concerned with home security, labour, and the supply of materials, and the local authorities primarily responsible for public lighting. We mentioned, too, that major attention had been paid to the problems involved in the full restoration of lighting rather than to those of partial lighting for an indefinite period. The Industry—we are speaking in general terms—was ready to provide a very big percentage of normal lighting on the word "go," and to complete the job very speedily. We know that the Gas Light and Coke Company, for example, has been fully prepared to restore full lighting within a matter of 24 hours once the edict had gone forth.

But there is a great deal of difference between normal lighting and moonlight lighting. Adaptation of existing lamps to the interim moonlight standard involves substantial labour and considerable expense. The question has not been one of technical difficulties; it has been the open one whether for what may prove a short span the labour and expense are fully warranted, the question being all the less easy of decision in that modification of the lamps from moonlight to normal will mean further labour and further expense—and a further inevitable time-lag in the restoration of peacetime illumination which the public obviously desires. There has been noticeable of late public, or at any rate popular Press, impatience about the

progress which is being made in this matter of moonlight illumination—an impatience due to lack of awareness of the considerations involved.

If in this connexion we refer at the moment to "interim" lighting in the London area and specifically to the area of the Gas Light and Coke Company, we do so to give a picture of the conditions which prevail in that area, and of the principles which must have much more widespread application. We have spoken of the double time-barrier imposed by conversion to moonlight illumination and the subsequent stepping-up to normal values. In the area of the Gas Light, there are no fewer than 38 local authorities which employ gas for street lighting and are financially responsible for its operation. The position has been explained to them, and we may state that the cost of conversion and subsequent reconversion to full lighting, which the authorities naturally will have to bear, has been put at £2 per lamp. The decision to proceed rests with the authorities concerned. Speed of conversion necessarily depends on the availability of the skilled and semi-skilled labour required for the work, but the Gas Company has gone to great lengths to ensure that this aspect shall not impose a difficult problem. Bearing in mind the incertitude of the dim-out period all local authorities are not of the same mind. To date, the authorities who have accepted the Gas Company's proposals number 13, and account for the conversion to dim-out of some 4,000 lamps. It is expected that a further 10 authorities will adopt a similar course, and that 23 local authorities in the Company's area will be responsible for some 15,000 dim-out gas lighting units. In passing, we may mention that under normal conditions the 38 authorities concerned were enjoying the lighting service given by about 110,000 gas street lamps. The point we would emphasize is that delay in giving effect to the lighting relaxations allowed by the Government is not traceable to lack of preparedness of the Gas Industry.

Finally we may refer to another important aspect of the lack of uniformity in adopting dim-out lighting and in the speed of its installation, and that is the question of street accidents in the dim-out. As matters stand at present and appear likely to develop, during the interim period of darkness between blackout relaxation and victory lighting patchiness of lighting would seem inevitable, and it has been shown beyond dispute that patchiness is the reverse of a safety factor. From the night-motorist's point of view the need for continuous readjustment of vision in passing from dim-out lighting to utter blackness, and back again to dim-out of maybe a different value in certain areas, demands the exercise of great care and caution and is exceedingly trying—or such is the impression we have gained following conversation on the subject with several motorists whose duties render night driving necessary. And this, we think, is not made easier by the "dim-out reaction" of many pedestrians, who take risks in the dim-out which they would hesitate to take in the blackout. The feeling of added security in this respect engendered in the pedestrian by moonlight lighting is understandable enough, but as far as accidents on the road are concerned it would seem to us a feeling to be warned against.

GAS RESEARCH IN U.S.A.

AT the request of the Office of Defence Transportation and by vote of the A.G.A. Executive Board, this year's annual convention of the American Gas Association, which was to have been held in Chicago last month, was cancelled. Other important organizations, such as the American Petroleum Institute and the American Society of Mechanical Engineers, agreed upon a similar course. This patriotic move, we read in *Gas Age*, did not prevent meetings at Philadelphia of the International Federation of Homing Pigeon Fanciers, at Milwaukee of the Concatenated Order of Ho Hoo, at Los Angeles of the Anti-Cigarette League, and in Chicago of the American Guild of Banjoists, Mandolinists, and Guitarists—to say nothing of the National Button Society.

That, however, by the way. Actually the A.G.A. did have a short meeting to transact formal business. And at that meeting an important proposal was made and found approval—a programme to raise another million dollars annually for an initial three-year period for research and promotional development in the Gas Industry. The new plan calls for a yearly expenditure of $400,000 on general research on production, transmission, and distribution, and $200,000 on utilization research on domestic, industrial, and commercial appliances. Last year the Association spent nearly $200,000 on research and development, so that the new programme envisages a very great expansion in activity and scope. It is proposed that the money should be raised by voluntary contributions on a percentage basis on gross revenues from the various gas undertakings—those to whom the work is likely to be more readily applicable, the manufactured gas undertakings, paying at a higher rate than the natural gas undertakings. As far as national advertising and "sales promotion" are concerned, the idea is to make available over the period mentioned a sum of $800,000 a year; this includes a contribution of $200,000 for the appliance and equipment manufacturers. The whole represents a large sum of money. A comparative picture is gained, however, when we consider that in 1943 the electricity industry in the States spent five times as much in national and local advertising as did the Gas Industry there.

Not long ago the A.G.A. sought the views of gas undertakings on the question of appliance research. Improved appearance, it was stressed, should be sought in all appliances, because "with the manufacturing facilities, the inventive imagination, and the wealth of new materials which will be released after the war we can easily be outclassed by an aggressive, far-sighted competition unless we have taken strides in the interim to perfect our present position." And generally co-operation was urged between gas undertakings, the manufacturers of appliances, the A.G.A. Laboratories and the Institute of Gas Technology. In point of fact the gas research work in America would appear to be well linked-up, and we were interested in reading a day or two ago the latest account of the progress made by the Institute, which organization, it may be recalled, was brought into being in 1941 with the objects of training men, research, the collection and dissemination of scientific information, and the encouragement of independent research within the Industry. Pure research and research on problems basic to the Industry are carried on from general funds provided through contributions from member undertakings; patents from developments belong to the Institute, but are available to member undertakings on a licence basis. Research conducted for individual undertakings or groups of undertakings is confidential, and the results or patents are available only to the sponsoring undertakings. The entire financial structure of the Institute is built on the principle of small yearly contributions from a large number of supporting undertakings.

In the three years which have elapsed since its foundation, and in spite of the difficulties of war, the Institute has gone forward and would seem to have carved out for itself a permanent position of usefulness. Payments to the Institute—again based on the gross earnings of individual member undertakings—vary from $100 to $5,000 annually. Voluntary contributions of no stipulated amount are also made. The aim is to secure, through contractual memberships, an annual income of at least $100,000 a year. In addition, and the figures apply to the 1944–45 programme, $137,000 has been received as a result of "sponsored research." There is no paucity of equipment in the eight laboratories of the Institute, which, according to all descriptions, lack nothing that would seriously hinder the activities of its research workers, though a fund is contemplated for the setting-up of new buildings in addition to those already erected. The aims are ambitious, but the enthusiasm is there; and as for the Library, we learn that no effort is being spared to make it the finest in America devoted exclusively to the technology of gas.

This general determination to carry out more research work on gas manufacture and utilization in the States and to undertake it in appropriate and dignified surroundings seems calcu-

lated to enhance the prestige of the American Gas Industry. It is obvious that much of the work contemplated is largely parallel to that being done in our own country. It is to be hoped that as we take note of American progress, so will our friends in the States study our own. Many of the problems are common.

Personal

The Directors of the Gas Light and Coke Company have decided to appoint an officer who shall be responsible for policy in relation to all employees, salaried or wage earning. They have therefore appointed Mr. W. S. Gooch as Staff Controller. Mr. Gooch, who until about a year ago was Divisional Manager of the Company's Western Division, will act under the direct authority of the Managing Director.

Letter to the Editor

Recognition of the Gas Staff Association

Dear Sir,—Your readers may be interested to learn that the Gas Staff Association has achieved full recognition by the employers. A letter dated Nov. 3 has now been received from the Federation of Gas Employers (London District Committee) stating that "the Gas Staff Association is now officially recognized by the Employers' Federation."

This recognition follows a declaration that the Association has attained a majority membership of the staffs of each of the four London Companies at present concerned (Commercial, Gas Light and Coke, Hornsey, and North Middlesex).

The officers of the G.S.A. were recently invited to Kensington to meet Mr. A. E. Sylvester and Mr. Brian Wood (Managing Director and Secretary respectively of the Gas Light & Coke Company) representing the Gas Light. They had a mutually helpful hour with these gentlemen, with a frank interchange of views. They felt much encouraged at the reception they had, and appreciated Mr. Sylvester's stimulating and enlightened remarks on such questions as personnel and staff treatment and opportunities.

Mr. Sylvester welcomed the Association, and wished it every success. He expressed his view of the importance of the human element in any business, and has stated publicly his conviction that the Gas Industry of the future will be no stronger than its personnel.

It is felt that all this augurs well for the success of future negotiations between the Gas Staff Association and the employers. The next step will be to arrange suitable negotiating machinery. A tentative approach has already been made to the Central Committee of Gas Staff Associations (representing the staffs of four other companies in the London District), in the hope that some measure of co-ordination may be achieved in the near future. We are all working for one common purpose—the welfare of gas staffs everywhere.

Meantime, great interest in the Association is being shown from staffs of gas undertakings all over the country, and branches outside London are already being organized. A Sub-Committee is engaged in drafting plans for regional organization.

A very great deal of preliminary work has been done. Some of the pioneers in this work have already attended more than 60 meetings during the organizational period. There are some critics who would have us try and run before learning to walk, but those responsible for the inauguration of this new Association have had to contend with much inertia and many conflicting views. It has been felt wise to form the Association first in a small way, on a solid and satisfactory foundation within the London Area, before going all out to organize nationally. That natural development will doubtless follow in due course, and growth will be facilitated now that the requisite machinery is established in the London nucleus—machinery so designed that expansion is foreseen and provided for.

North Middlesex Gas Company,
Mill Hill, N.W. 7.
Nov. 21, 1944.

Wilfred H. Davey,
Vice-Chairman and Press and Public Relations Officer,
The Gas Staff Association.

London Juniors

A well-attended meeting of the London and Southern District Junior Gas Association was held at Gas Industry House on Friday evening last under the Presidency of Mr. R. F. Twist, when Mr. J. E. Davis, of the South Metropolitan Gas Company, gave a Paper under the title "Evolution in Fuel Supply." The Paper, which was followed by a most enthusiastic discussion, will be published in a subsequent issue of the "Journal." A vote of thanks to the Author was proposed by Mr. F. C. Smith (Gas Light and Coke) and seconded by Mr. T. S. Ricketts (Tottenham and District). The meeting was brought to a close by the President's announcement that the next gathering would take place at Gas Industry House on Dec. 15, when a Paper would be given by Mr. C. A. Deas, of the Tottenham and District Gas Company.

Scheme for Articled Pupils

Much has been said of late about attracting the right men into the Gas Industry. But what is being done about it? Apropos this, we learn that the Boards of Severn Valley Gas Corporation and Gas Consolidation, Ltd., have introduced schemes for attracting to their organizations the right type of entrants into the Gas Industry. These schemes provide for the training of suitable youths as members of The Institution of Gas Engineers, and do not overlook the importance of the supply side of the Industry.

The schemes are, in fact, actually in operation, and the terms offered to the right type of articled pupil (details of which are given below), have been very favourably commented upon by educationists, careers masters in Public Schools, and the headmasters of Grammar Schools and High Schools.

Particularly new and attractive features of the schemes are that intending pupils are freed from any financial restriction against their entering the Industry, thereby widening considerably the choice of suitable entrants, who are selected only after the strictest investigation by a Committee appointed for the purpose. These terms include that no premium is payable, and that the pupil receives remuneration during the period of his articled pupilage at the following rates: 1st year, £65; 2nd year, £91; 3rd year, £120; 4th year, £160; 5th year, £200.

In addition a subsistence allowance of £50 per annum would be granted to a pupil obliged to serve away from his home town.

This pioneer work is warmly to be commended, and the sponsors deserve excellent results from their enterprise.

Diary

Nov. 30.—Eastern Counties Gas Engineers' and Managers' Association: Autumn Meeting, Gas Industry House. Papers by Dr. J. G. King and Dr. F. J. Dent.

Dec. 5.—Domestic Heat Services Committee: Gas Industry House, 2.30 p.m.

Dec. 13.—Southern Association of Gas Engineers and Managers (Eastern District): Gas Industry House, 2.30 p.m. Paper by C. A. Deas, "Horizontal Retort House Operation and Works Power Supply."

Mr. Mitchell, Ministry of Aircraft Production, has recently joined the staff of Messrs. George Wilson Gas Meters, Ltd. Mr. D. Kennedy has relinquished his position with this firm.

The Minister of Fuel and Power has refused to sanction an increase in the price of gas at Southport, and has suggested that the Gas Committee should draw on reserves, earmarked for renovations and re-equipment after the war, to meet the increased cost of labour and materials put forward as a reason for the proposed increase.

National Savings Certificates to mark their completion of fifty years' service with the Newcastle-upon-Tyne and Gateshead Gas Company were presented to Mr. E. Weddell, Mr. H. Willis, and Mr. C. Bolam at a gathering of the staff at the Newcastle offices of the Company last week. The presentations were made by Mr. J. E. Parker, President of the Officers' Guild.

An Unusual National Savings Campaign has been arranged for the New Year by the Reigate, Redhill, and District National Savings Committee, the result of which will be watched with widespread interest, since it should make a strong and topical appeal to old and, new savers, especially those having members of the Forces on distant and sometimes forgotten battle fronts. Mr. J. R. W. Alexander, Chairman of the Publicity Committee, informs us that during the month of January next it is intended, in a "Not Forgotten" National Savings Campaign, to save £100,000 with which to equip and maintain a British medical unit in the Far East, as a tribute from the citizens of the Borough of Reigate to the Fighting Forces of the Crown in that expanding theatre of war.

The North Cheshire Industrial Canteen Association held its inaugural meeting at the St. Petersgate showrooms of the Stockport Gas Department on Nov. 13, when Mrs. E. Hinchcliffe, 75, Clarendon Road, Hyde, was appointed secretary and treasurer, and a committee of nine was elected. After the meeting a film show was given by the courtesy of the Liverpool Gas Company, depicting "Democracy at Work" and "The Value of Canteens to Industrial Workers." The objects of the Association include the co-ordination of all efforts towards the provision, maintenance, and improvement of canteens, the raising of the standard of catering, and the interchange of information in regard to the theory and practice of catering. Meetings are to be held on the first Monday in each month, and an invitation is extended to anyone interested in canteen work to write to the secretary for further particulars of the Association.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

Gas and Coke Equipment in the Northolt Houses

IN the "JOURNAL" of Oct. 4 we described the demonstration houses at Northolt, and both that issue and the one on Oct. 11 had editorial comment on the part played by the Gas Industry. The houses, we may recall, were erected by the Ministry of Works primarily to show to local authorities and others interested in building the possibilities of material other than the traditional brick for house construction. From the point of view of the general public, however, the main interest lies in the planning, the services, and the equipment of the houses. In the past, houses have too often been built without regard to the necessity for clean, labour-saving fuel equipment, economical in use. Unless provision is made for suitable appliances in the initial planning of the house, the occupants are often unable to afford them, since it is always considerably more expensive to install the appliances after the house is built.

Not all the houses have been completed with interior fittings, but all (with the exception of the two houses equipped by the electrical industry) have been piped for gas; gas cookers, gas refrigerators, gas wash-coppers, gas water heaters, and gas fires are shown. Gas points, with flush plug-in sockets, have also been fitted adjacent to the solid fuel-burning appliances in some cases, so that gas pokers may be attached for easy lighting, or portable gas heaters used. Even the Dudley house designed for rural areas has been piped for gas, although solid fuel-burning appliances are shown. There is likely to be a rapid extension of gas supply to villages after the war, and it is advisable, therefore, for houses erected in many rural areas to be piped ready for the installation of gas equipment when supplies of gas become available.

As mentioned in the "JOURNAL" of Oct. 4, to illustrate suitable methods of terraced building for urban houses a terrace of four brick houses has been erected (Ministry of Works Type No. 8). Two of these houses have been equipped by the Gas Industry and two by the electrical industry. The houses have not been designed by the two industries, but have been built to the Ministry of Works' plans, and equipped by the gas and electrical industries on the lines they would recommend for houses of this design. Of the two houses equipped by the Gas Industry, one is fitted to use only gas for heating, cooking, refrigeration, water heating and laundry work; the other for the use of gas and coke. These two houses illustrate the practicability of supplying a smokeless, labour-saving service for all these domestic requirements at a price within the reach of those of limited means. The standard of comfort and hot water service is much higher than that usually supplied before the war.

The local prices of gas and coke, and the method of living as it affects the relative periods of use of the dining-kitchen and living room, will be the main factors in deciding the proportions of gas and coke used to provide the domestic heat services. The two systems chosen illustrate the two extremes of likely variation, and are arranged so that they may be altered at small cost to suit the requirements of occupants of the houses. In general plan the houses are alike, consisting of an entrance hall, living room, and kitchen with dining-annexe, on the ground floor, and three bedrooms, bathroom, and separate W.C. on the first floor.

We now supplement our general account given previously by a detailed illustrated description of the gas and coke equipment installed, together with estimated fuel consumptions and running costs for the two houses.

Equipment in the Two Gas Industry Houses

The majority of appliances installed in the houses are necessarily of the pre-war type, since appliances manufacturers have been engaged on essential war work during the last five years. It is hoped that when new types of appliances are available they will be substituted. Technical improvements have, however, been made in certain appliances. In addition special problems arose in connexion with building-in appliances. These unusual features are dealt with in the following notes.

The Two Gas Cookers.

The kitchen in the Gas house is fitted with a vertical cooker, having the oven underneath the hotplate, while in the Gas and Coke house a horizontal type is fitted with the oven placed at the side of the hotplate, so that the top of the oven is level with the hotplate and the sink unit. The vertical cooker is mounted on a plinth with toe space to match the cupboard units, while the horizontal type is mounted on cupboard units. Both cookers are suitable for low cost housing, and are finished in cream and green vitreous enamel to match the other kitchen fittings. The hotplates are finished in black vitreous enamel. Fixed injectors are fitted to both cookers, the gas supply being governed at the meter.

Both cookers have front reading thermostats and are flush sided and built-in with kitchen fitments. The backs are flush for placing against a tiled wall. The oven flue gases pass into the hotplate space in the case of the vertical cooker and into a trough behind the hotplate in the horizontal type. The trough is covered by a black vitreous enamel grid. Special provision is made with both cookers to ensure that drips from the fitments on either side of the hotplate are directed into the hotplate space. In the case of the vertical cooker two gutters catch drips and direct them into the crown tray; with the horizontal type the gutters communicate with the trough behind the hotplate which receives the oven gases. The trough can easily be cleaned by removing the grid.

The space available for the horizontal cooker enables a flint lighter to be fitted between the oven and the hotplate. This lighter is conveniently placed for lighting the hotplate and oven burners of the cooker, the gas circulator and the gas poker for the coke boiler.

The oven and the filling-in plate behind the lighter (which also houses the gas connexions) are covered by a detachable cream vitreous enamelled table top. The top can be lifted off for maintenance of the oven tap, thermostat, oven flue, and gas supplies.

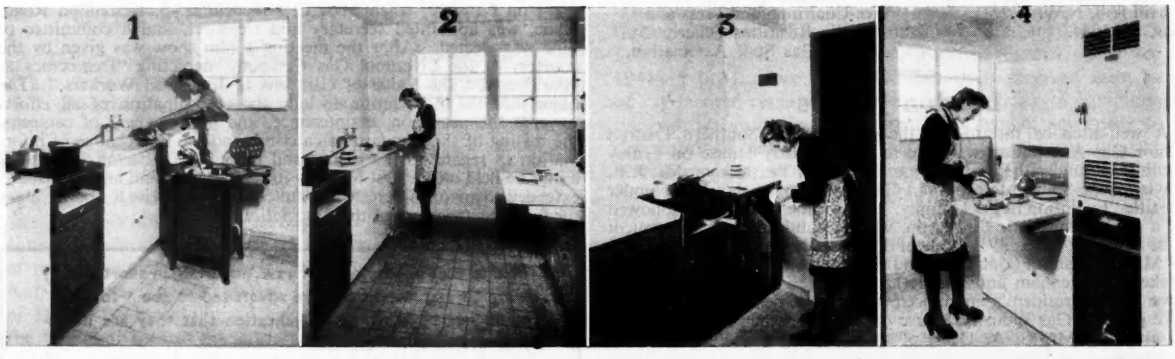
(The vertical cooker is pictured in photographs Nos. 1 and 2, and the horizontal cooker in photograph No. 3.)

Refrigerator.

The built-in type is used in each house and is fitted at a high level, giving the maximum convenience to the user. The unit is completely self-contained with its ventilating louvres incorporated, and can readily be withdrawn for maintenance when needed. The use of an improved type of flue ensures that the refrigerator should operate over a period of years without need for maintenance. The refrigerator (shown in photograph No. 4) is finished in a durable cream paint to match the decoration of the kitchen equipment.

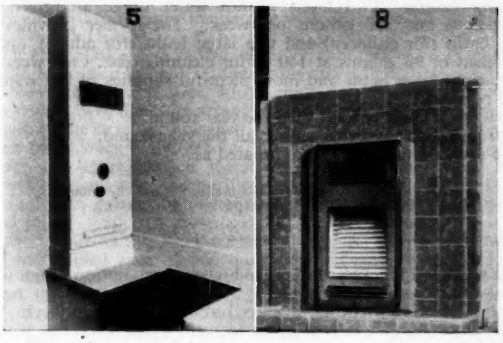
Gas Water Heaters.

Standard pre-war heaters of proved performance have been used, but their incorporation into the general architectural scheme has required various modifications. The main requirement was that the gas and water connexions, baffler, and flue pipe should be concealed, leaving only a front panel for the housewife to clean. A directional outlet baffler, as distinct from the conventional free outlet baffler, has been designed with streamlined interior to reduce the internal resistance to a minimum and only a front outlet provided covered by a louvred grill. This design of baffler fulfils the requirements of B.S.S. 766. The baffler, being fitted to a brick flue running up to beyond the roof ridge, acts as a room ventilator whether the appliance is in use or not, so that the louvred opening in the kitchen is generally



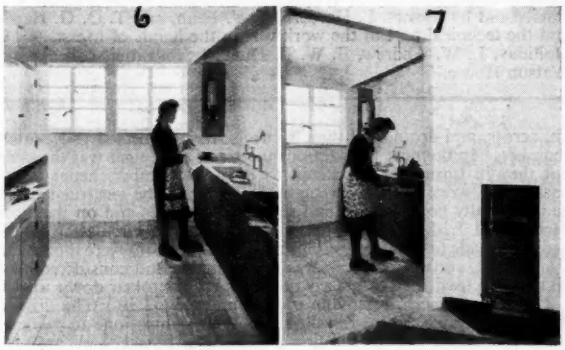
a kitchen ventilator, and only in the exceptional case of downdraught is it necessary to perform its function as downdraught outlet.

(a) *Multi-point Instantaneous.*—The heating body is carried on two cross strips across the back of an angle-iron box frame which stands on the cupboard in the corner of the kitchen and is screwed to the wall. The exposed side and front are covered with a one-piece pressing (painted to match the surrounding colour scheme), which can be removed for maintenance. The gas tap and lighting hole, and the louvred baffler-outlet, are visible on the front face. The heater is connected to the tank supply to give a constant water pressure (see photograph No. 5, which shows how the heater is "boxed-in.")



(b) *Circulator.*—The heating unit is housed in a box, recessed into the wall dividing the kitchen from its annexe. The front of the box is covered with a panel fitted flush to the wall surface, and painted to match the surrounding colour scheme. The gas tap and lighting hole are visible on the face of the panel, which also carries the louvring over the outlet of the special baffler. The connexions for the flow and return, flue, and gas supply are outside the back of the box for connecting up in the usual manner.

(c) *Sink Heater.*—This heater (shown in photograph No. 6) is recessed into the wall, but not at the moment built-in as is the case with the other two heaters. The outlet spout is extended, by a chased-in connexion from the heater recess on the left-hand side of the sink, to a swivel spout (which can be pushed back against the wall when necessary) above the sink taps.



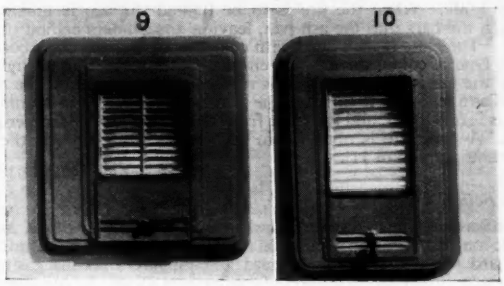
The Coke Boiler.

The boiler (see photograph No. 7) is finished in vitreous enamel and is modern in appearance. It has a shaking grate to make the clearing of the ash easy, and has ample fuel capacity so that it will remain alight up to 16 hours without attention.

The Convector Fire.

There are several features about the new convector gas fire which make it specially suitable for long-period heating. In addition to the normal radiant efficiency there is extra convected efficiency. Cool air passes into the fire at the base and over the convector box before coming out into the room as warm air. This warm air not only increases the overall efficiency of the fire, but is valuable also as a method of heating the air of the room directly. The burners are non-aerated and the radiants are of a very robust rod type; the ribbed front face of the back firebrick functions as the back of the radiant. The practically unbreakable radiant taken in conjunction with the non-aerated burners reduces the maintenance cost of the fire considerably. As the fire is intended for long-period use it is essential that it should turn down satisfactorily to about one-third of the full heat output. This is obtained by the use of a duplex tap, but the arrangement of the radiants is such that the appearance of the fire remains good even when it is burning at half rate. The control tap is situated at the top of the fire to avoid stooping. The front decorative panel of the fire, which is finished in vitreous enamel, is readily removed to give access to the radiants, brick, and convector box. The sides of the fire are finished in heat-resisting paint.

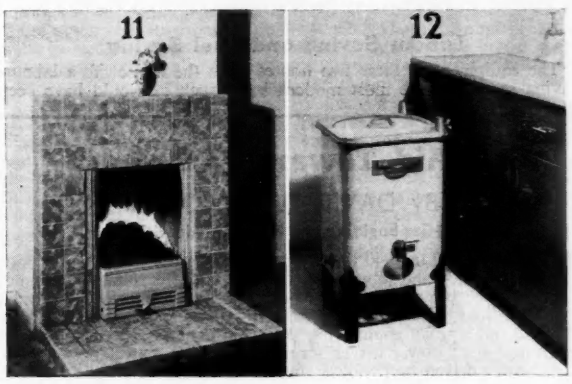
The gas consumption of the fire full on is 30 cu.ft. per hour; the duplex tap cuts down the sides of the fire, leaving the centre portion burning about 15 cu.ft. per hour. This can be again turned down to



about 10 cu.ft. per hour. The average consumption of the fire when used for long-period heating in the living room will be about 15 cu.ft. per hour, giving 12 to 13 hours' heating for 1 therm of gas. With this type of fire a saving of about one-third of the gas compared with the ordinary type of fire can be expected (see photograph No. 8).

Gas Fires in the Bedrooms.

Four out of the six fires in the bedrooms represent technical advances on the fires normally used up to 1939. They are not only of modern appearance, but the radiant used is of a particularly robust type and the burner is non-aerated. These improvements result in a completely silent fire, and the appearance and performance will be satisfactory



over a period of many years without any need for maintenance (see photographs Nos. 9 and 10).

The Open Coke Grate.

The grate is designed to give a higher radiant efficency and a more flexible heat output than that obtained pre-war. The firebars are supported on the frame and shelf. Four studs along the front of the firebars reduce the conduction of heat to the front of the grate. The frame is rigidly fixed to the hearth, and is adjustable to fit closely to the firebricks; the sides are sloped to direct the ash into the ashpan. The front of the grate is pulled tightly against the firebricks to prevent air entering the ash pit at this point. A shaped brick runs along the front of the fire, reducing the rate of conduction of heat from the base to the front of the fire, so that the coke is kept hot. By keeping the front of the fire hot the radiant efficiency of the coke is increased and the fire burns up quickly. When recharging the fire with fresh coke the hot coke can be pulled forward and the fresh charge dropped at the back, thereby keeping the room temperature more constant.

The adjustable damper makes possible the close control of the primary air supply. Air entering the ash pit has a very much greater effect on the rate of combustion of coke than the air which passes over its surface, and providing the fireplace opening is not less than 20 in. high the rate of combustion can be controlled by the ash pit damper. This damper is operated by a simple movement of the lever whereby the primary air supply passing under the grate can be regulated from *nil* to the maximum that the draught can be induced. The correct spacing of the louvres has been arrived at by experiment, so that when the damper is fully opened the same amount of air can pass under the grate as when the front of the grate is removed entirely. The front is virtually air-tight, so that when the damper is closed practically no air can enter under the grate. Thus, by regulating the air supply the fire can be reduced to slow combustion, but readily burns up to a bright fire when required.

The fuel is ignited by gas, the gas ignition burner being incorporated in the grate. When the fire is to be lighted the ash is first raked through the bars into the ash pan, leaving the cinders behind on the grate. The grate is then filled with coke (about 8½ to 11 lb. according to the type of coke), the ash pan emptied, and the gas burner lighted. While the gas is on the ash pan is replaced, but the front of the fire is left off as a reminder to turn off the gas. After about 15 to 20 minutes the gas is turned off, and the grate front replaced with the damper fully open. A good fire is obtained in 40 minutes from lighting the gas (see photograph No. 11).

Wash Boiler.

The wash boiler is fitted with wheels on the back two legs and a handle on the front to enable it to be easily withdrawn from the cupboard under the draining board and plugged into the gas point by the side. The plug on the end of the flexible tube can be conveniently tucked into the handle when the boiler is put away. In order to get the wash boiler in the restricted space available, the draw-off cock is of special design and the flue outlet consists of louvres in the back panel. Strengthened sockets are provided for fixing a wringer—the latter being mounted on extension pieces to bring it up to the height of the sink. A folding shelf is fitted to the wringer to guide clothes into the sink, and still leave the boiler sufficiently far away from the sink to enable the handle of the wringer to be turned.

The base is finned to improve the thermal efficiency, and a saving in gas of about 25% is obtained. A special type of luminous burner is used which screws directly on to the pan. The gas rate is 15,000 B.Th.U. per hour, and it is intended that the boiler should be filled from the hot water supply. (The boiler is shown in photograph No. 12.)

Washing Machine.

This is of conventional design with agitator, but is fitted with wheels on the two back legs and a handle on the front to enable the machine to be easily withdrawn from the space under the refrigerator.

Labour Saving and Fuel Saving

The equipment in these two houses gives the housewife a labour-saving service of the most modern kind, such as would have been found before the war only in the houses of those who could afford to install equipment of their own choice at their own expense. In both houses the dirt, labour, and expense of frequent chimney sweeping are eliminated; and, of course, the use of gas and coke is a definite contribution to coal economy.

The following are the estimated fuel consumptions and running costs for the houses. The estimates (South of England) are based on the requirements of a family of two adults and two children, with the following services:

Room heating: Both the dining annexe and living room heated 28 weeks during the year; short period heating in each bedroom for 19 weeks; background heating in the hall for the coldest 7 weeks. In the gas-and-coke house a portable heater is used instead of the coke fire in the living room during 9 mild weeks.

Water heating: Two levels of hot water usage are given—*i.e.*, 220 gallons and 350 gallons per week. The former provides four small baths (for children) and two large baths (for adults), and the equivalent of 90 gallons at 140°F. for cleaning, &c., each week; the latter, eight large baths and more plentiful supplies of hot water for other purposes.

Cooking: Complete service all the year round.

Refrigeration: Complete service all the year round.

The fuel consumptions are estimated as:

House.	Gas per annum (therms).	Coke per annum (cwt.).
Gas-and-coke ...	285 (335) ...	45
Gas	555 (660) ...	—

The figures in brackets are for the higher consumption of hot water.

Pre-war expenditure on fuel by weekly wage earners for heating services (excluding lighting) averaged about 5s. 6d. per week. This figure did not, of course, include refrigeration, which was not generally available in low-cost housing; a sum of 9d. a week has been included for the running of the refrigerator.

Running Costs.

Houses.	Coke at 45s. per ton. Gas at 9d. per therm.	
Gas-and-coke	6s. 1d.	(6s. 10d.)
Gas	8s. 0d.	(9s. 3d.)

The figures in brackets are for the higher consumption of hot water.

In those parts of the country where suitable tariffs are available the running costs of the gas house may be comparable with those of the gas-and-coke house.

As mains were already laid to the site at Northolt where the Government houses have been erected, no question of charges for mains arose. The services, internal piping, fixing of appliances and equipment were charged to the Government.

As a final note it may be mentioned that the houses we have described are in the area of the Gas Light and Coke Company. The negotiations with the Ministry of Works and arrangements on the site were carried out by Messrs. L. Hardern, T. V. Fenn, and T. O. G. Harris, and the technical part of the work was in the hands of Messrs. G. C. Holliday, L. W. Andrew, E. W. B. Dunning, and their colleagues at Watson House.

Self Aid Towards Efficiency*

By DAVID L. DICKSON

(Gas Engineer and Manager, Airdrie)

WE realized in 1940 that the ancillary plant at Airdrie was in poor condition and so we decided to overhaul the plant. This immediately brought up the question of tools, and as it was appreciated that we should be severely handicapped without equipment, we gradually laid out a small engineering shop and equipped it with essential machines—*e.g.*, power driven screwing machine, power driven hack saw, power driven buff, power driven vertical to take up to 1¼ in., portable power driven drilling machine to take up to ½ in. with stand to use it as pillar drill; we also got all necessary tools for oxy-acetylene and oxy-coal gas welding, and made an arrangement with a local firm of boiler-makers for the hire of their electric welding unit as required.

But for this equipment we could not have carried on. Of course we had to have our men trained in welding, and in this we were most fortunate, since Coatbridge, our near neighbours, have a very up-to-date technical school and welding was one of the principal subjects taught. We cannot speak too highly of our experience in this branch of engineering, and it is my considered opinion that no works of any size should be without those tools and the men to work them.

One of our first tasks was to overcome ammonia difficulties, since ammonia was passing in much too large quantities to our purifiers. This we overcame by bringing up-to-date an old tower scrubber which had been out of commission for years. This scrubber was 6 ft. square and 30 ft. high, divided internally into four sections approximately 3 ft. square. In the first two sections the travel of the gas was up, across, and down, and these sections were connected to a bottom chamber. In the next two sections the travel of the gas was the same, but they in turn were connected to the top chamber, hence it was possible to work up two strengths of liquor. The vertical sections had originally been divided and separated by grids and on these had been placed Irish broom twigs, and liquor from circulating pumps had been made to flow over this filling. These sections were thoroughly cleaned out, and since broom was unobtainable and considered inadvisable, we used broken glazed tiles and brick broken down to pass a 2 in. square mesh, removing everything below 1 in. The original pumps were done, so we installed two Weir pumps, one to work on each compartment. On the first two vertical passages we arranged to spray the circulating liquor in at a pressure of 40 lb. through two nozzles. The effect of this was to atomize the ingoing liquor and give a finely divided spray, which brought down a considerable proportion of the tar left over from the condensers. In the remaining two vertical columns we circulated liquor through open ends, so keeping in circulation a much larger volume. This proved a great success, and we are now able in the winter to operate our liquor up to 12 Twaddell strength in the bottom chamber and 11½ Twaddell in the top.

As you can observe, we were very successful, and this in turn allowed of our putting out of commission our brush scrubber and we brought in the makers of this unit and had it thoroughly overhauled, it being fitted with a new shaft, rebrushed, and the driving engine sent back to the makers and thoroughly reconditioned. With both units in commission we have been able to reduce the ammonia content in the crude gas passing to the purifiers to slightly under 9 grains per 100 cu.ft., which we consider reasonable.

One of the next jobs was to overcome back-pressure difficulties, which we traced to purifiers and the mains leading from purifiers to station meter and from the station meter to the holder. At that time our back pressure showed at 24 in. W.G. and was quite often out of the

* From a Presidential Address to the Scottish Junior Gas Association (Western District).

gauge. We found that our trouble was due principally to naphthalene, and that the deposits were so heavy that it was impossible to consider dissolving it. This naphthalene was, of course, a legacy from the old horizontal retorts and had occasioned much trouble in previous years. Formerly, where we had a good run and large traps, we did dissolve much of it with gas oil. Strangely enough most of our naphthalene difficulties occurred in the summer, and we put this down to the fact that the gas now made contained only traces of naphthalene, and in hot weather it was thus able to pick up considerable quantities from that previously deposited, which it carried forward and again deposited at cooler points in our mains. That this was the case we proved one forenoon after a most brilliant day of sunshine, when without any warning both the inlet and outlet pipes to our No. 3 Holder closed up completely and cut off the supply. The outlet pipe we freed without much difficulty, but the inlet proved most difficult, and we finally had to dissolve the deposit with gas oil and steaming before it was finally cleared.

Our examination had shown, however, that to make a thorough job we would require to open up the mains and scrape them out. To do so meant considerable time, which could not be afforded at any one shut-down. We therefore arranged to provide a temporary connexion to by-pass the strip to be cleaned. This we did and made a connexion direct from Weck Valve No. 4 Purifier outlet to inlet of main gas-holder, by-passing station meter, &c. This done we then cut the respective mains near the purifier outlet and holder inlet and capped each off, thus permitting of our working without haste and making a good job.

Before starting this work we went over every purifier, cleaned each out and refilled each afresh, thus reducing the risk to a minimum, since we did not know what we might run up against and how long we might take. In view of the fact that our purifiers were controlled by a Weck valve, it meant that our purifier rotation was fixed so long as we had the temporary connexion, and also we could not throw any one purifier off for cleaning, since this meant by-passing all our purifiers owing to the construction of the Weck valve. It was as well that we took all those precautions, for our cut revealed that the 15 in. mains in both cases were absolutely full and the maximum passage for gas was 6 in. diameter. On a stretch of 100 yds. we had to cut the main in eight places, removing at least 3 ft. of main each time to give us working room, and we started off in each case by first passing a chain through the main by means of drain rods; then we fixed two scrapers of 6 in. diameter to each side of a 4 ft. rod. This was drawn through in one direction, then back again, the arrangement being such that one man was always kept on the drag rope to prevent the discs sticking. This proved a very tiresome and arduous method, and resulted, as already stated, in our making more cuts than was first thought necessary. However, by increasing the diameter of the discs up to approximately the full bore of the pipe we managed to get all the naphthalene out, and in every case we finished up by drawing an oversize rubber plunger through the main, so removing all particles adhering to the side. Since naphthalene present in our gas rarely exceeded 5 grains per 100 cu.ft., and this before benzole extraction was practised, we are reasonably assured of no further trouble from fresh deposits.

When we were at it we opened up the station meter and examined it; here again we had ample evidence of naphthalene. This was not surprising, since the meter stood unprotected and was exposed to all weather. We removed the top cover and manholes and gave it a thorough clean-out, but we found that the drum was badly holed and very stiff to turn. We cleaned the shaft, patched the drum, and re-assembled it, and after jointing all mains, once more passed gas through its normal correct circuit. Our work had been well worth the trouble, for with the meter in commission the back pressure was reduced by 5 in., and with the meter by-passed, a further 2–3 in. reduction was obtained. Apart from immediate relief in back pressure, our work had shown us that the meter was in a poor state and was not registering correctly, as had been suspected for quite a few years, so we decided to go in for a new meter and ultimately installed a Connersville, which has given the utmost satisfaction. Altogether with the make we were then producing our back pressure was reduced from over 24 in. to 10 in. W.G.

We discovered during this period that our Weck valve was not functioning well and that foul gas was being passed through into our holder, particularly when a certain rotation of purifiers was being operated. This could only mean one thing—leaky seats—and since the valve was of a very old type, and no drawings were available, we decided to arrange for a shut-down on a Sunday (that being the most suitable day), and thoroughly examine the internal seatings and discs of at least one section. This we did and found that not only the discs but all the ring seats were badly pitted. The discs were of the solid pattern and had no renewable alloy ring. Full dimensions of the valve were taken, and it was decided to install two new discs and new spindles where necessary. This allowed for our getting the old discs and having them refaced, and this removed part of our difficulty. However, we found in the section we examined that the seats were so bad that it would be impossible to reface them in the time at our disposal, so we decided to fit false seats. This we did by arranging to have cast and turned out to our drawing and dimensions ring seats, which we slipped into the old seat in the form of a sleeve bedded-in (in red lead) and made to rest on a projecting collar. In the case of the bottom seat, this was simply held in position by jamb screws screwed into false seat, but in the top position this procedure was reversed and the studs were passed through clearance holes in the false seats and screwed into the metal comprising the ring seat, thus insuring against the seat falling out. This method of curing our troubles was found to be excellent, so much so that we went over all the Weck valve in record time, having only five shut-downs for this particular job, one to determine the trouble, and one for each of the four sections.

Our storage capacity consists of two gasholders. The main holder for the district has a capacity of 650,000 cu.ft. and is a double lift column-guided holder, throwing a pressure of 5½ in. W.G. on the bottom lift and 3½ in. W.G. on the top, and we also have a 70,000 cu.ft. column-guided water gas relief holder. Both holders have brick tanks finished off at ground level, and in each case the holders were situated at the foot of hilly sections in our works. This had resulted in ashes and other road material being washed into the tank of each holder until in both cases the deposit had become so great as to make it unsafe for the main holder to be uncupped, or the smaller unit worked to any more than 60% of its capacity. Indeed the larger holder had uncupped under those conditions six years previously, with the result that the bottom curb rail was bent, due to the tilt that the holder took, and this in turn compressed the side sheet and stays, with the result that the stays were bent and the plates so badly buckled that it was definitely dangerous to work the holder in the top lift.

Our first step was to stop the cause of the trouble. This we did in each case by building dwarf retaining walls round the tank at the spot where the dirt was being washed over, extending them round the tank sufficiently far to allow of all sediment being washed well away from the tank. Luckily the accumulation in each case was all in one spot, so that we had no difficulty in locating it. We then, after much difficulty, obtained a pump capable of meeting our demands, which we hired from a neighbouring A.R.P. authority. This unit was a centrifugal pump (4 in. suction) driven by a petrol engine, the whole being housed in a portable frame and capable of being towed. At that time we were only allowed the use of this unit, which was absolutely new, on the understanding that an attendant was sent with it and that it was returned each night to the Local Authority Depot. The pump was first tried out on the small holder. This holder was not in use, and our procedure was simply to lower the open end of the suction pipe on to the bank of silt, start the engine, and allow the delivery to discharge on to the ground, where we had a series of battens, 1 ft. high, run in a series of bays, so placed that the discharge was contained within those battens and made to circulate at a low speed, ultimately passing through a brick filter into the tank. By this means and by agitating the silt by rods the deposit at the bottom of the holder 20 ft. down was gradually drawn up and passed over the circuit beds, from which it was periodically removed. It was surprising what we discovered; among the various articles were a gun-fire clock, an old alarm clock, old boots, bottles, stones up to 2½ in., which were actually forced through the pump, and in one case with the larger holder our suction pipe became choked, and on removing the pipe with the engine running we found, before breaking the surface of the water, a piece of coal tightly wedged against the suction pipe which was more than 14 lb. in weight. Much the same procedure was carried out with the larger holder; in this case the holder was in continuous use, and at the end of a fortnight's intermittent running we cleared the deposit away from both tanks.

Altogether we took over 20 tons of silt from the two holder tanks, and in the case of the small water gas relief holder we proved conclusively that our experiment had been a success, for we have since had it grounded.

We still could not use the large holder in view of the bad dents in the plates, so we called in the makers and we agreed to try to remedy the matters with the holder in operation. As the worst buckled plates were the lowest in the bottom lift we had to operate on Sundays, when it was possible to keep the holder full for a fairly long period. It being summer-time we managed to get from 7 a.m. until the draw came on about 12 a.m. The procedure was to cut large holes near the worst bent vertical stays, insert cleeks round the stays, and by means of blocks and tackles exert a pull, so that the stays were gradually straightened. Of course this had to be worked gradually and systematically from one side of the damaged part right round to the other good edge by tightening the pull at some points and slackening at others. By so doing the bulges were gradually reduced in depth, and although not completely removed, were so reduced that it was considered that the holder could be allowed to uncup without the danger of sticking. Altogether the bulges were reduced at the worst places from a depth of approximately 12 in. to approximately 6 in. Of course at the worst points it was the plates which had suffered most and we had to patch quite a bit. However, the holder is much safer to operate and, of course, is less unsightly when fully inflated.

The Metronic Instrument Company, Ltd., of Smethwick, have begun the issue of a series of articles describing in simple language the fundamentals of positive and inferential flow measurement of liquids and gases. The articles are primarily for the benefit of the man whose duties include flow measurement, and the information is designed to enable the reader to make reliable flow computations which satisfy the B.S. Specification on Inferential Flow Measurement. We are informed by the firm (196, Grove Lane, Smethwick 40, Staffs) that they will be happy to add to their mailing list the names of subscribers to the "GAS JOURNAL" who are interested in the subject.

Wales Juniors

Education of future engineers in the Gas Industry and the development of sales organization and training of sales personnel were the principal topics at a meeting of the Wales and Monmouthshire Junior Gas Association held at the offices of the Cardiff Gas Light & Coke Company on Nov. 2.

The retiring President, Mr. Darrell W. Rees (Pembroke Dock), presided at the opening of the meeting, and a welcome on behalf of the Cardiff Company was expressed by Mr. B. J. Bell.

Mr. W. R. Branson, M.Sc., Assoc.M.Inst.C.E., Assistant Engineer, Cardiff Gas Light and Coke Company, was inducted as President for the ensuing year.

In vacating the chair for Mr. Branson, Mr. D. W. Rees said that during the comparatively brief time Mr. Branson had been in Cardiff he had been an ardent worker for the Association, which now appeared to be on a stronger footing than ever.

PRESIDENTIAL ADDRESS

of Mr. W. R. Branson

The recruitment and training of technical staffs has been widely discussed, and I hope I may be forgiven for addressing you to-day on this subject, since I regard it as of vital importance. As recently as last June Mr. G. C. Pearson presented to The Institution of Gas Engineers a Paper on the "Training and Qualities of the Future Gas Engineer"—a Paper which deserves very careful study. My remarks to-day can add little to Mr. Pearson's contribution, but may serve to underline some of the points made therein.

In all that has been said and written on the post-war planning of British industry, great prominence has been given to the need for more research and little to the means by which the results of research are to be applied. There may be some danger that, as a result, research may come to be considered in a watertight compartment, unconnected with the day-to-day routine of industry. This in turn may lead to disappointment when it is found that the mere appointment of research staffs or subscription to research associations does not automatically result in either increased efficiency or bigger dividends. Much greater emphasis needs to be laid on the application of research results, and on the need for constant consultation and exchange of views between the technician and the research worker.

Co-operative research has been carried out by the Gas Industry for a number of years, yet it is probably true to say that there are dozens, if not hundreds, of works in which the findings of research committees are disregarded. Credit for the application of the results of recent developments must be given principally to the firms of contractors who have frequently incorporated in gas-works plant improvements which have not been specifically demanded by undertakings. A marked contrast is provided by other industries, such as oil and radio, both of which have undergone radical change in recent years as a result of the application of new discoveries. Such a comparison may not be entirely fair to the older industry, but I believe there is a lesson to be learned from it—namely, that the application of new processes and their efficient operation depend on the existence of technical works staffs adequately trained in the fundamental sciences and capable of appreciating the new techniques, backed by directors and admininstrators who have an understanding of what science can do for industry.

The Education Scheme of The Institution of Gas Engineers has been of great value, but I believe that much remains to be done to improve further the education and training of the Industry's technicians.

Here I would like to emphasize the distinction made by Mr. John Terrace in a contribution to the symposium "The Gas Industry: 1941 and After" between education and instruction. The early stages of training need to be planned with a view to inculcating an ability to think clearly, and to giving a sound understanding of the fundamentals of scientific method rather than to cramming the student with factual information.

With this in view it is obviously desirable that all entrants to the Industry aspiring to membership of the I.G.E. should be required to produce evidence of having had a suitable general education. The Institution in turn might take steps to ensure that members do not accept pupils, articled or not, who have not attained this standard. The ideal would be for all entrants to the Industry, with ambition to attain to the higher technical and administrative positions, to have had a university training. This may not be immediately practicable, but the adoption of a scheme similar to that of the Monmouthshire and South Wales Coal Owners would undoubtedly be a big step in this direction. This scheme was described in a Paper to the South Wales Institute of Engineers by Mr. Iestyn Williams and Professor T. David Jones in 1942. Briefly it consists in the selection, either from boys leaving school or from young men already engaged in mining, of those most likely to benefit by a university education and to become efficient mining engineers. Participating colliery companies engage those selected as junior officials, and pay a salary on a rising scale from the time of appointment until five years after a Colliery Manager's Certificate has been obtained. An agreement is entered into whereby the junior official undertakes to attend a three-year course in the Mining Department of the University of Wales at Cardiff and to pay the fees from his salary. Having obtained his degree the junior official continues the practical training, begun during the university vacations, until the necessary minimum of three years' experience underground qualifies for admission to examination for the Colliery Manager's Certificate. This having been obtained, the junior official may be employed in any capacity, but is guaranteed a minimum salary of £400 per annum for five years thereafter.

Few individual gas undertakings could adopt such a scheme, but I see no reason why, modified to suit conditions in the Gas Industry, it could not be adopted regionally in conjunction with the university in each area. If the scales of remuneration offered were at least as high as those of the South Wales Coalowners' Scheme, boys of the right type would be attracted to the Industry and a solution to the vexed question of salaries might be in sight.

The university course need not be specifically concerned with gas engineering, at least in the first two years, but rather should it be designed to teach the principles of the sciences on which gas engineering depend, and in the third year might concentrate on fuel technology. In this way the same course should serve entrants to the Industry who would ultimately be engaged as works chemists and technical salesmen as well as works engineers. It might prove possible to include firms of gas contractors in the arrangements, so that experience of drawing office and erection department could be included in the practical training, while contractors could recruit staff through this scheme.

It is extremely debatable whether some works experience should be obtained prior to entering the university. The mining engineers' scheme already referred to provides for only one month at this stage. Without going fully into the pros and cons of the question I would suggest a maximum of six months in the works prior to starting the degree course. This has the advantage of bringing a boy into early contact with works conditions, and with the men whom he will later be required to supervise. At the same time too long an interruption of the habit of study is avoided.

Works training could be continued during university vacations and after graduation until sufficient practical experience had been gained to sit for the I.G.E. examinations.

Except in the largest gas undertakings, it has not been possible for a young engineer to obtain that variety of experience which is desirable without change of situation. A co-operative scheme such as has been envisaged should make possible arrangements for training on a regional basis as suggested by Mr. Pearson in the Paper to which I referred earlier.

Practical training would need to be supplemented by instruction in part-time day or evening classes, but with a university course behind him the junior should be able to concentrate on the specialized subjects of gas engineering. The long hours at present necessary in order to cover both principal and ancillary subjects should no longer be necessary.

Here I should like to make a plea for amendment of the I.G.E. regulations, so that a candidate for membership should be required to take a single qualifying examination instead of, as may now happen, sitting successively for Ordinary Grade, Higher Grade, and Diploma examinations.

The provision of the necessary specialized teachers for part-time instructions needs careful consideration, as there is undoubtedly a shortage of qualified men prepared to undertake this work.

The employment of men trained on the lines suggested may by impracticable for many of the smallest works, which are numericalle predominant in South Wales. It is outside the scope of my subject this afternoon to go fully into means by which this difficulty might be overcome. It is perhaps not unreasonable to hope that, if co-operation in a scheme of education and training could be achieved, co-operation might be extended to the sharing of technical staff between a number of contiguous undertakings.

Time does not permit of discussion of the recruitment and training of men for the sales and fitting side of the Industry or for positions such as carbonizing foremen, for which some theoretical instruction would be of advantage. I should like, however, to express a personal need which is probably shared by many others in the Industry. Short refresher courses, when series of lectures might be given by acknowledged experts in the new techniques, would, I am sure, be a welcome innovation. However assiduously one follows the technical Press, recent developments are apt to leave one behind the times.

You may feel perhaps that my subject to-day has been one in which we, as members of a Junior Gas Association, cannot take an active part. There is, however, one aspect of education in which the junior associations have played and can continue to play an important role. Complaints have been voiced in many quarters that applicants for positions or examination candidates are frequently unable to express their thoughts clearly or to develop logical arguments. Such abilities are only developed by practice, and it seems to me that the junior associations provide an ideal opportunity for such practice.

In preparing Papers and entering into the discussions members may contribute to their own education, and obtain experience which will stand them in good stead when called upon to prepare reports for or express opinions to boards of directors or gas committees. If they served no other purpose this alone would, I believe, justify the existence of the junior gas associations.

A vote of thanks to Mr. Branson was proposed by Mr. REES and seconded by Mr. I. G. JENKINS.

Mr. BRANSON presented Mr. Rees with the Presidential Certificate as a record of his year of office.

"Great Argument"

A Paper was presented by Mr. R. J. Gregg, Sales Manager of Ascot Gas Water Heaters, Ltd. This Paper was published in full in the November issue of *Gas Service*.

In the ensuing discussion—

Mr. S. D. COOLE (Barry) thought that an adequate salary to enable the salesman to be free to devote his full attention to his work was necessary. He also thought a census of the district served should be made to discover what appliances were in use in the field.

Mr. GREGG said he believed that shortly industry would need efficient and virile sales organizations.

Mr. C. B. CHURCH (Newport) thought it was unfortunate that the Gas Industry had not attached sufficient importance to their salesmen. They had classed salesmen as canvassers—a degrading term. He was of the opinion that commission should be cut out.

Mr. D. W. REES said they had not in many cases in the Gas Industry the right type of person as salesman. Perhaps they should talk in terms of selling service.

Mr. T. E. TYRELL (Port Talbot) asked if there was a danger of shoddy material being issued after the war to recompense for the loss of the past five years.

Mr. GREGG emphatically replied that the only policy they had in mind was improvement.

Mr. K. M. ERNEST (Cardiff) said that to-day more than ever the Gas Industry was split up into two sections, the manufacturing side —concerned particularly with the manufacture of good quality gas— and the distribution side. The attitude that the responsibilities of the Gas Industry ended with the delivery of gas to a consumer's premises would have to end.

Mr. P. J. WRIDE (Swansea) pointed out how the company's gas-fitter acquired a personal knowledge of the people with whom he dealt.

Mr. B. J. BELL was afraid Mr. Gregg was almost condemnatory in his attitude. It was somewhere around 1900 that the showroom was started and salesmen were appointed. It must not be forgotten that in most cities the purchasing potentialities had only been touched. The Industry had been engaged in supplying the needs of the people. As apparatus had advanced so the type of salesman had been forthcoming to meet the requirements, with good results. The Gas Industry had never been inefficient. It had never lacked efficiency or virility, and they needed no more of those qualities than they had had in the past.

A vote of thanks to Mr. Gregg was proposed by Mr. R. H. BONE (Cardiff) and seconded by Mr. D. I. ROWLANDS (Caerphilly).

Mr. C. E. WHYATT (Commercial Manager of Ascot Water Heaters) also briefly addressed the meeting.

Service and Personnel*

By ARTHUR BELL

Sales and Service Superintendent, Exeter Gaslight and Coke Company

I AM convinced that every undertaking will need to put into operation a comprehensive scheme for the maintenance of applicances on the district, whether company or consumer owned. It is obvious that such a scheme will cost money, and also that in the final analysis it is the consumer who must bear the cost. By what method shall this cost be recovered? At present some undertakings adopt the principle of selling gas and appliances at the cheapest possible rate, and make consumers pay direct for service; while others include in their charges for gas or equipment a sufficient cover to give an extensive free (so-called) service.

I do not propose to argue the relative merits of the two systems, further than to say that on the one hand if a consumer has to pay a direct charge for service, he seldom obtains the fullest advantage of an undertaking's service organization; whereas if a service charge is included in the price of gas, the large consumer is generally penalized, and the small consumer is able to get considerably more service than he pays for. A considerable amount of dissatisfaction is likely to be caused if consumers used to a free maintenance service remove to an area where a charge is made. It is evident, therefore, that the question requires much consideration, and it will undoubtedly have a bearing upon regional price fixing.

An invaluable part in our service can be fulfilled by women employed as Home Service Advisers. This is an avenue of approach which should not be neglected by any undertaking. It is probably possible for even small undertakings, who may individually be unable to afford the full cost, to co-operate with a neighbour and share the cost of the services of a Demonstrator Adviser on a part-time basis. A woman will often receive a complaint from a consumer that would not have been given to a man. It is only by receiving complaints and dealing promptly and efficiently with them that we can hope to maintain goodwill.

* From a Presidential Address to the Western Junior Gas Association.

Training of Personnel

I speak principally of gasfitters, though much of what I say will apply equally to students in gas engineering and supply. It is a truism that the gasfitter is the ambassador of the gas undertaking. He is, apart from meter readers and prepayment collectors, the man in most frequent and direct contact with the customers, and it is generally found that consumers judge a gas undertaking in the light of the service, good or otherwise, provided by the fitting staff.

In most undertakings, especially in those of medium size, the gas-fitter is looked upon as the representative (in the fullest sense) of the gas undertaking, and his advice is sought on any problem connected with the activities of the company. For this reason it is essential that care should be taken in the choice and training of youths from whose ranks the fitters of the future are to come. The gasfitter of the future, then, must be alert, intelligent, clean, and smart in his appearance, and capable of gaining the full confidence of our consumers.

We in Exeter have for many years had in operation a training scheme which has provided us with a particularly high standard of gasfitter. Constant touch has been kept with the Principal of the local technical school, and in pre-war years we were usually successful in obtaining sufficient candidates for apprenticeship through this medium. These boys had received the advantage of two years' thorough technical training, including mathematics, machine drawing and construction, workshop practice, &c. On such an educative foundation it is possible to build.

In general, boys are taken on for a few months' probationary period, and, if satisfactory, indentures binding the boy for five years are prepared, for signature by the candidate and the parent on the one hand and the Directors of the Company on the other. A condition of the indentures is that the boy shall attend approved evening classes during the whole of the five-year period. These classes, conducted at the Technical School, cover the five-year course in Gasfitting under the City and Guilds of London Institute, and the teachers in both theory and practice are drawn from our own staff and senior fitters. All fees are paid by the Company, and the course is further subsidized to the extent that we provide all material used in the practical classes.

Apprentices are placed with selected fitters for training on the district, and are changed fairly frequently among the senior fitters, so that they get thoroughly representative experience.

At intervals they are brought into the workshop and given instruction in workshop practice, cooker and water heater repair and maintenance, tinsmith's work, &c. Incidentally, we insist on all fitters qualifying in plumbing and tinsmith work. Before the end of the five years' apprenticeship we try to arrange a period of training in main and service laying. Regular reports of conduct and progress are called for, and if necessary parents are called in and asked to co-operate in taking any special measures that may be necessary. No opportunity is lost of impressing upon the boys the need to give first-class service, and that our livelihood depends upon the excellence of our service.

Advantage is taken from time to time of technical talks by manufacturers' representatives, and we have found these a source of much interest.

During the past 10 or 15 years the number of our students who have obtained distinctions and prizes will bear comparison with any undertaking in the country, and we are justly proud of this result of careful selection and training. I may say that since the outbreak of war, in view of the great attractions offered to boys in the specialized services, we have had to lower our standard and at times take boys from elementary schools. These boys have not proved so successful as those from the Technical School. With some of the boys we have received quite glowing reports from headmasters, but there is a decided sameness about these reports, and one wonders whether a duplicated copy is turned out on the occasion when a boy leaves school. It is with profound regret that I have to say, notwithstanding the greatly increased amount spent nationally on education, that some of these boys seem totally incapable of understanding the simplest mathematical calculation, and they can hardly put together one coherent sentence in a written answer to a question.

Post-War Training

The education and training of thousands of young men within the Gas Industry has been interrupted because of war service. What are we going to do about this?

So far as our own apprentices here in Exeter are concerned, we have exercised the privilege of obtaining deferments for them until they reached the age of 20. In addition we have taken special measures to step up their training and education, so that they have been enabled to sit for the Final Grade Examination in Gasfitting before they commenced their military training.

We also took what steps were available, to recommend our trained personnel for technical, mechanical, and practical branches of the Forces, so that their special qualifications might be used to the best advantage. In many cases this is having a further advantage in that men are in jobs which will enable them to maintain their familiarity with the use of tools.

These young men will, we anticipate, come back into the Gas Industry after varying periods of absence up to probably more years than anyone realized. They will have forgotten much of their early training and will have lost touch with new developments within the

Industry. Many of them went as youths but will return as men, possibly having married and assumed other responsibilities. In the enormous building programme foreseen in the post-war years we shall need these men, but first they will need a period of training in special refresher courses. Who is to bear the responsibility and expense in connexion with this educational project? In the past, manufacturers of gas appliances have been ready to place facilities in the way of trained lecturers, workshops, &c., at the disposal of individual undertakings. It is certain that even if they were willing, the manufacturers could cope with only a small fraction of the number which will be involved, and, incidentally, they are not likely to be much better placed for such purposes than we are. While it is unlikely that demobilization will take place in such haphazard conditions as existed after the last great war, the time will come when men will need to be drafted back into industry almost as fast as they were drafted into the Forces.

I think that it will be imperative for the Government to adopt special training schemes for the rehabilitation of men released, and I hope the advice will be sought of those within our Industry who are competent to discuss the needs of our particular trades. Individual undertakings will also be well advised to look into their own organization, to see if they are in a position to extend and amplify any national training schemes to conform with local conditions.

I have no doubt that both the manufacturers and undertakings within the Industry will do all in their power to help in such projects, but it is the responsibility of the Government to subsidize the scheme, while the men are being made ready once more to take up their jobs. Great care will need to be exercised to avoid leaving any feeling of patronage or charity in the minds of these trainees while so engaged. They will have deserved the best we can do towards restoring them to jobs in which they can take their rightful part in planning and building the new Britain we so much desire.

Development of Gas Appliances

I wonder whether, in 10 years' time, any piece of new gas-consuming apparatus will bear much resemblance to its present counterpart. Considerable development, for example, took place in cooker construction between 1923 and 1939, but certain fundamental principles remained substantially unaltered. We appear due to enter an era when to "aerate or not to aerate" will be the contentious question throughout the Industry. I certainly think that Mr. Dean Chandler has got in on the ground floor by coining the term "neat gas burners"—a very apt title, and one likely to stick.

In the present state of development much more experience of district use will be needed before non-aerated burners become generally adopted on gas cookers, although a good case can be made out for their use. I have recently had the privilege of seeing two separate cookers (together with other appliances), having all neat gas burner equipment, and I must confess that I was very much impressed by each. One of these cookers showed the result of a good many years' work by Mr. Dean Chandler, and the other was the product of a well-known firm of gas appliance manufacturers. Both have apparently been in use for considerable periods on the district, and this is, in my opinion, the only possible way in which any appliance can be properly tested.

I was able to see cooking operations carried out in one of the cookers, and the results, both in the oven and on the hotplate, left little to be desired. The appliances were governed, therefore no adjustment beyond the original setting was necessary, and maintenance was said to be negligible. I foresee rapid developments in this sphere within the next few years.

We have, of course, been using the neat gas principle in water heaters and fires for a considerable period. In about 1939 we adopted a fire with so-called luminous flames, and, following our tests, we anticipated considerable success in selling it. Unfortunately the war curtailed such activities, but I may say that the few which we sold and fixed on the district have given every satisfaction.

Scottish Western Juniors

A Meeting of the Scottish Junior Gas Association (Western District) was held at Airdrie on Nov. 11, the occasion being the 40th anniversary of the founding of the organization. Following an inspection of the Airdrie Corporation Gas-Works, Mr. D. L. Dickson, Engineer and Manager, Airdrie, President of the Association, gave his Address—see p. 702.

Mr. A. JAMIESON (President of the North British Association of Gas Managers) said that Mr. Dickson's brother, now Manager at Kirkintilloch, had also been President of the Juniors. He conveyed the good wishes of the North British Association. For years past the ambition of the Junior had been to occupy a managerial chair but, with some form of reconstruction almost a certainty in post-war years, managerial posts would not be so plentiful. There would, however, be a great and growing demand for specialists in distribution and utilization, whose remuneration and status would be higher than ever they had been. He suggested that they should direct their energies along these lines.

Mr. E. G. SMITH (Dunfermline) associated himself with Mr. Jamieson's remarks, and Mr. J. FULTON (Dumbarton; Past President) extended his best wishes to Mr. Dickson during his year of office.

The company was then entertained at tea by Airdrie Town Council, Provost Gray welcoming the guests and Bailie Bonner, Convener of the Gas Committee, who presided, paying tribute to Mr. Dickson's work.

Thereafter Mr. JAMES BELL, late Manager at Dumbarton, a former President and founder member of the Association, addressed the members. He said :

It is fully 40 years since I journeyed from this town in 1904, to attend a gathering of West of Scotland Juniors. The purpose of that occasion was the founding of this Association. The late Mr. Alexander Wilson, General Manager of the Glasgow Gas Department, was unanimously called upon to occupy the Chair. In acknowledging appreciation of the honour, Mr. Wilson remarked that he was delighted to be able to assist in getting our Association under way, and gave the new venture his paternal blessing. I can remember he was supported by a small platform party consisting of well-known gas managers of that day. The Association has now completed forty years of high and useful endeavour in the pursuit of technical and practical knowledge of Gas Engineering. He was truly a philosopher who wrote, "To travel hopefully is a better thing than to arrive"; and while we still travel hopefully, it may be appropriate at this time to halt for a little as we pass the fortieth milestone and take a backward glance over the way we have come.

I would like to recall the Address given by our first President, Mr. James Lowe, of Glasgow, in 1904. The keynote of that Address is struck in the opening query, which I quote: "Is the Industry possessed of the elements of stability and permanence in view of the increasing competition to which it is subjected?" The answer to this question is given most decisively by the verdict of history. These past 40 years have been years of noble endeavour and high accomplishment. The progress of the Gas Industry over that period has shown that it really did possess "potential" elements which enabled it to meet successfully the competition from other services. I use the word "potential" advisedly, because the principal factors which have contributed to the expansion and progress of the Gas Industry have been in great measure supplied from sources "outwith the ken" of the engineers of that time. For instance, well can I remember how optimistic and hopeful we were in those early discussions about capturing the field of power for town gas from our rivals of that day—namely, steam and electricity. Our optimism was at that time based on the question of cost. Time, however, has shown there are other factors besides the economic one, and to-day we must admit that the electric motor has ousted its rivals in the field of power. We have witnessed during the years under review a greater measure of success of electricity in this field than we had anticipated.

On the other hand, we have had outstanding success in other directions beyond the wildest dreams of the gas engineers of yesterday. It is as a heating agent that gas has found its most lucrative market. The number of processes to which the thermal energy of town gas is being applied to-day is great indeed. It can be claimed for gas that it holds the field almost completely in cooking the nation's food with 10,000,000 domestic gas cookers doing the job. In more recent years, to this load has been added domestic water heating, which was expanding rapidly until the outbreak of war. The gas fire in the bedroom has become a necessity, and along with the gas wash boiler had become largely standard equipment in housing development over the 20 years prior to 1939. In the workshops and factories we find gas being consumed in quantities that were never imagined in the past, and there seems to be no end to the possibilities in industrial technique for further expansion.

I am sure the working figures during the past 40 years of almost any gas undertaking in Great Britain would afford a measure of the Industry's progress in general. There are, of course, alternatives to town gas as a thermal agent, and to maintain the present position continued research is needed to improve existing technique in the economic utilization of the nation's coal reserves. We may be sure the oil interests have an eye on our industrial output. We can expect improvements in oil-burning equipment along with refinements in the preparation and composition of the fuel itself. It becomes the more necessary to direct greater attention to research with a view to improvements in our own technique and in service to our customers. I also think this a most appropriate time for the coal-mining and gas-producing interests to realize their common identity. It is unthinkable that two such important industries mutually dependent should continue in open rivalry.

I would like to finish on a personal note. I feel I would be failing in my duty if I omitted reference to the first President of this Association, Mr. James Lowe, now of Auckland, New Zealand. It is in his absence that I become your guest. I appreciate the honour, but at the same time I am deeply conscious of the fact that we would all have been very glad to have had the Association's first President with us to-day. We owe much to Mr. Lowe for his tact, guidance, and constant courtesy in the early and difficult days. Very few of the "old brigade" still share in the active participation and guidance of the Industry, but we realize that the management has passed into capable hands—probably more capable hands. We wish you all success, and trust you will continue to travel happily beyond this, the fortieth, milestone of your journey.

Mr. DAVID FULTON (Helensburgh, a former President, Secretary, and founder member) gave some reminiscences regarding the early days of the Association, recalling some of the prominent personalities and notable Papers of its first decade.

Products Prices—Stocks and Shares

The London Market Nov. 27.

There are no changes to report in the prices of Coal Tar Products.

A Government Order came into effect on March 1 controlling the price of Benzole and Coal Spirit and replacing the Control of Coal Tar Naphtha and Xylole Order, 1943.

The Order is known as the Control of Benzole and Coal Spirit Order, 1944 (S.R. & O. 1944, No. 172).*

By this Order the price of Motor Benzole is fixed at 2s. per gallon. The Order also lays down the method of evaluating Crude Benzole.

The Order also calls for periodical returns to the Ministry of Fuel and Power from all producers of Crude and Refined Benzole.

In connexion with the Coal Tar products market, the Government Order designated the Contol of Toluene (No. 4) Order, 1944 (S. R. & O. 1944, No. 170), contains an amendment of the Control of Toluene (No. 3) Order, 1943.

Attention is called to a new Government Order, which amends the price of Toluene as from Sept. 1, 1944. The Order is entitled, The Control of Benzole and Coal Spirit (No. 2) Order, 1944 (S. R. & O., No. 988).

The only change in connexion with the prices of Coal Tar Products refers to Naphthalene. A new Government Order, entitled the Coal Tar Products Prices (No. 2) Order, 1944 (S. R. & O. 1944, No. 1051), allows increases in the maximum prices for all forms of Naphthalene. The new Order came into force on Sept. 22, 1944.

* Slightly amended by Control of Benzole and Coal Spirit (No. 2) Order, 1944, which amendments came into force on Oct. 1.

The Provinces Nov. 27.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 2s. to 2s. 2½d., pure, 2s. 9d. (now controlled by S. R. & O. 1944, No. 988, operative from Sept. 1, 1944. Benzole and Coal Spirit, also Coal Tar Naphtha and Xylole, are now controlled by the Control of Benzole and Coal Spirit Order, 1944, dated Feb. 18, 1944, S. R. & O. 1944, No. 172, operative from March 1, and S. R. & O. 1944, No. 988, part 1, operative from Oct. 1, 1944. Carbolic acid, 60's, anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.), and strained anthracene oil controlled by the Coal Tar Products Prices Order, 1943, dated Oct. 20, 1943 (S. R. & O. 1943, No. 1528), operative from Nov. 15, 1943. Naphthalene now controlled under S. R. & O. 1944, No. 1051, operative from Sept. 22, 1944.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Scotland Nov. 25.

Deliveries continue at a satisfactory volume. Refined tar*: Yield to distillers is 4½d. per gallon *ex* Works, naked. Creosote oil: Timber preserving quality,* 5½d. to 6½d.; hydrogenation oil,* 5⅞d.; low gravity or virgin oil,† 7½d. to 7½d.; benzole absorbing oil,* 6½d. to 8d. per gallon. Refined cresylic acid* is 3s. 6d. to 4s. 6d. per gallon, *ex* Works, naked, according to quality. Crude naphtha†: 6½d. to 7d. per gallon. Solvent naphtha*: Basic prices delivered in bulk, 90/160 grade, 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 2d. per gallon. Pyridine†: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

* Price controlled. † Uncontrolled.

There was some irregularity at the opening last week although the general undertone was steady. A resumption of support for British Funds brought about some small rises in price, and favourable results led to selective buying among industrials. Home rails also attracted more attention towards the close.

The volume of business in the gas market was a little less than in the previous week, but prices were well maintained. Ordinary stocks were in fair demand, and it will be seen that a number of these were marked up. Bombay stock was a feature with a sharp gain of 2s. South Metropolitan preference stocks again received support and the 6% stock closed 2 points higher, while in the Supplementary List Croydon 4% preference rose 4 points.

The following price changes took place during the week:

OFFICIAL LIST.

Bombay	39/—41/-	+2/-
Bournemouth max. div.	157—162	+2
Gas Light 4 p.c. Pref....	101—103	+½
Ditto 3¾ p.c. Red. Pref.	100¾—102¼	+½
Imperial Continental	117⅞—120½	+¼
Plymouth & Stonehouse Ord. ...	111—116	+1
Portsmouth Cons.	128—133	+1
South-Eastern Gas Corporation Ord.	21/3—22/3	+-/3d.
South Metropolitan 6 p.c. Pref. ...	128—133	+2
Ditto 4 p.c. Pref.	100—103	+1
United Kingdom Gas Corporation Ord.	21/3—22/3	+-/3d.
Uxbridge Ord.	120—125	+1
Wandsworth 4 p.c. Pref.	99—102	+½

SUPPLEMENTARY LIST

Croydon 4 p.c. Pref.	99—104	+4

TRADE CARDS

FULL particulars of these spaces can be obtained on application to the Publishers. They are designed principally for the use of the firms whose display advertisements cannot be included owing to paper rationing.

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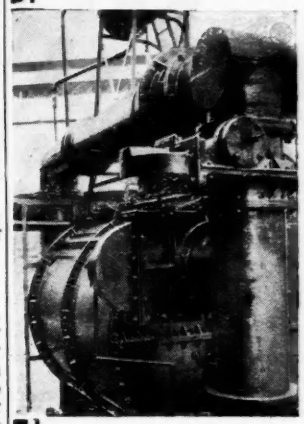
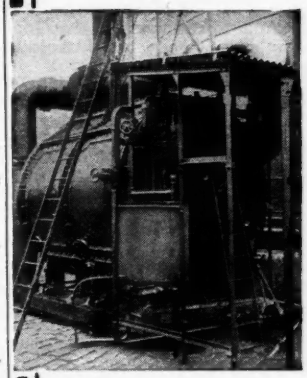


"Permac" Joints in a Gas Works.



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"Permac" the original Metal-to-Metal Jointing makes leak-proof joints that last till you want to break them down. Stands up to all temperatures and pressures. Equally successful on steam, gas, water, oil joints.

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